

EXERCISES

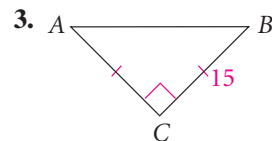
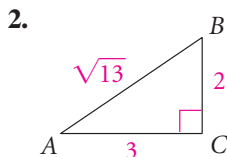
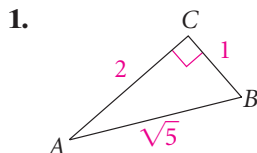
For more practice, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

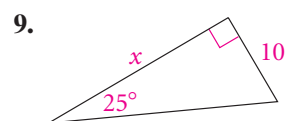
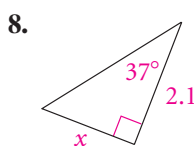
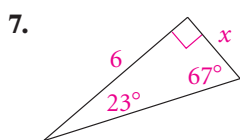
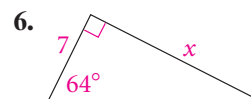
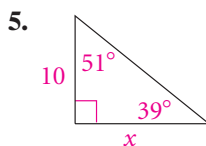
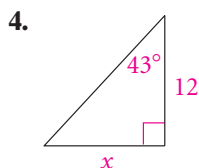
Example 1
(page 471)

Write the tangent ratios for $\angle A$ and $\angle B$.

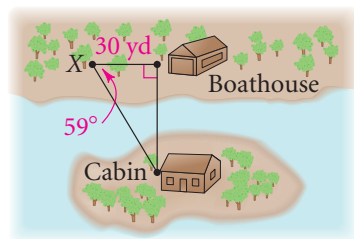


Example 2
(page 471)

Find the value of x to the nearest tenth.

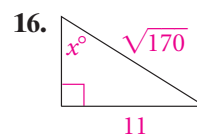
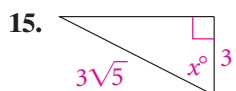
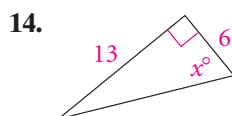
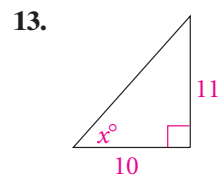
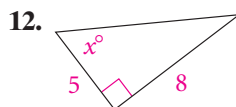
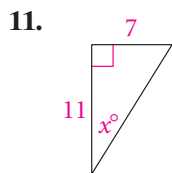


10. **Surveying** To find the distance from the boathouse on shore to the cabin on the island, a surveyor measures from the boathouse to point X as shown. He then finds $m\angle X$ with an instrument called a transit. Use the surveyor's measurements to find the distance from the boathouse to the cabin.



Example 3
(page 472)

Find the value of x to the nearest degree.



Find each missing value to the nearest tenth.

17. $\tan \square^\circ = 3.5$

18. $\tan 34^\circ = \frac{\square}{20}$

19. $\tan 2^\circ = \frac{4}{\square}$

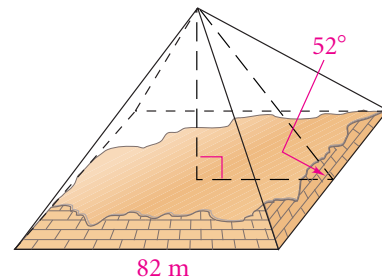
20. $\tan \square^\circ = 90$

B Apply Your Skills

21. The lengths of the diagonals of a rhombus are 2 in. and 5 in. Find the measures of the angles of the rhombus to the nearest degree.



- 22. Pyramids** All but two of the pyramids built by the ancient Egyptians have faces inclined at 52° angles. Suppose an archaeologist discovers the ruins of a pyramid. Most of the pyramid has eroded, but she is able to determine that the length of a side of the square base is 82 m. How tall was the pyramid, assuming its faces were inclined at 52° ? Round your answer to the nearest meter.



Need Help?

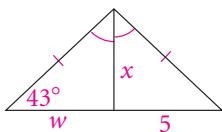
A Pythagorean triple is a set of three nonzero whole numbers, a , b , and c , for which $a^2 + b^2 = c^2$ (p. 357).



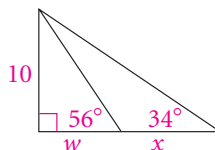
- 23. Open-Ended** Select a Pythagorean triple other than a multiple of 3, 4, 5. Find the measures of the acute angles of the right triangle associated with your Pythagorean triple. Round each measure to the nearest tenth.
- 24. Writing** Explain why $\tan 60^\circ = \sqrt{3}$. Include a diagram with your explanation.
- 25.** Explain why $\tan^{-1} \frac{\sqrt{2}}{\sqrt{2}} = 45^\circ$.
- 26.** A rectangle is 80 cm long and 20 cm wide. To the nearest degree, find the measures of the angles formed by the diagonals at the center of the rectangle.

Find the value of w , then x . Round lengths of segments to the nearest tenth. Round angle measures to the nearest degree.

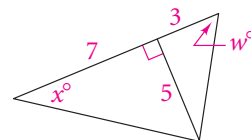
27.



28.



29.



- 30. a. Coordinate Geometry** Complete the table of values at the right. Give table entries to the nearest tenth.
- b.** Plot the points $(x, \tan x^\circ)$ on the coordinate plane. Connect the points with a smooth curve.
- c.** What happens to the tangent ratio as the angle measure x approaches 0? Approaches 90?
- d.** Use your graph to estimate each value.
- $\tan \blacksquare^\circ = 7$ $\tan 68^\circ = \blacksquare$ $\tan \blacksquare^\circ = 3.5$

x	$\tan x^\circ$
5	\blacksquare
10	\blacksquare
\vdots	\vdots
85	\blacksquare



Engineering The grade of a road or a railway road bed is the ratio $\frac{\text{rise}}{\text{run}}$, usually expressed as a percent. For example, a railway with a grade of 5% rises 5 ft for every 100 ft of horizontal distance.

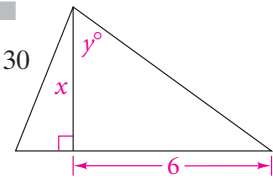
- 31.** The Katoomba Railway, pictured at left, has a grade of 122%. What angle does its roadbed make with the horizontal?
- 32.** The Johnstown, Pennsylvania, inclined railway was built as a “lifesaver” after the Johnstown flood of 1889. It has a 987-ft run at a 71% grade. How high does this railway lift its passengers?
- 33.** The Fenelon Place Elevator railway in Dubuque, Iowa, lifts passengers 189 ft to the top of a bluff. It has an 83% grade. How long is this railway?
- 34.** The Duquesne Incline Plane Company’s roadway in Pittsburgh, Pennsylvania, climbs Mt. Washington, located above the mouth of the Monongahela River. It reaches a height of 400 ft with a 793-ft incline. What is its grade?

Find the missing value to the nearest tenth.

35. $x = 2, y = \square$ 36. $x = 2\sqrt{3}, y = \square$ 37. $x = 6, y = \square$

38. $x = 6\sqrt{3}, y = \square$ 39. $x = \square, y = 15$ 40. $x = \square, y = 30$

41. $x = \square, y = 45$ 42. $x = \square, y = 60$ 43. $x = \square, y = 75$



44. a. **Critical Thinking** Does $\tan A + \tan B = \tan(A + B)$ when $A + B < 90^\circ$? Explain.

b. **Reasoning** Does $\tan A - \tan B = \tan(A - B)$ when $A - B > 0$? Use part (a) and indirect reasoning to explain.



45. **Graphing Calculator** Use the **TABLE** feature of your graphing calculator to study $\tan X$ as X gets close to 90 . In the **Y=** screen, enter $Y1 = \tan X$.

a. Use the **TBLSET** feature so that X starts at 80 and changes by 1 . Access the **TABLE**. From the table, what is $\tan X$ for $X = 89$?

b. Perform a “numerical zoom in.” Use the **TBLSET** feature, so that X starts with 89 and changes by 0.1 . What is $\tan X$ for $X = 89.9$?

c. Continue to numerically zoom in on values close to 90 . What is the greatest value you can get for $\tan X$ on your calculator? How close is X to 90 ?



d. **Writing** Use right triangles to explain the behavior of $\tan X$ found above.



Take It to the NET

Graphing Calculator procedures online at www.PHSchool.com

Web Code: afe-2111



Challenge



46. **Graphing Calculator** Use the **TABLE** and graphing features of your graphing calculator to study the product $\tan X \cdot \tan(90 - X)$. In the **Y=** screen, enter $Y1 = \tan X \cdot \tan(90 - X)$.

a. Use the **TBLSET** feature so that X starts at 1 and changes by 1 . Access the **TABLE**. What do you notice?

b. Press **GRAPH**. What do you notice?

Proof c. Make a conjecture about $\tan X \cdot \tan(90 - X)$ based on parts (a) and (b). Write a paragraph proof of your conjecture.

Use the given information and \tan^{-1} to find $m\angle A$ to the nearest whole number.

47. $\tan 2A = 9.5144$

48. $\tan \frac{A}{3} = 0.4663$

49. $(\tan 5A)^2 = 0.3333$

50. $\frac{\tan A}{1 + \tan A} = 0.5437$

Simplify each expression. (Hint: Recall from p. 472 how to think of $\tan^{-1} x$.)

51. $\tan(\tan^{-1} x)$

52. $\tan^{-1}(\tan X)$

Coordinate Geometry You can use the slope of a line to find the measure of the acute angle that the line forms with any horizontal line.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = 3$$

$$\tan A = \frac{\text{opposite}}{\text{adjacent}} = 3$$

$$m\angle A = \tan^{-1}(3) \approx 71.6$$

To the nearest tenth, find the measure of the acute angle that the line forms with a horizontal line.

53. $y = \frac{1}{2}x + 6$

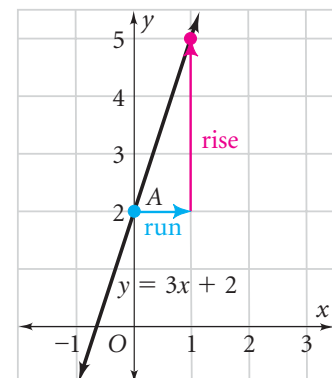
54. $y = 6x - 1$

55. $y = 5x - 7$

56. $y = \frac{4}{3}x - 1$

57. $3x - 4y = 8$

58. $-2x + 3y = 6$





Standardized Test Prep

Gridded Response

59. What is $\tan 84^\circ$ to the nearest tenth?

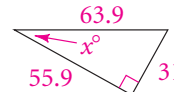
60. What is the whole number value of $\tan^{-1} \sqrt{3}$?

In Exercises 61–64 what is the value of x to the nearest tenth?

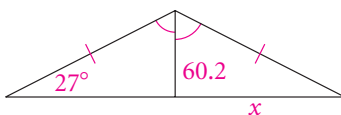
61.



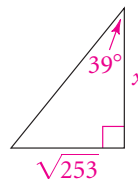
62.



63.



64.



Take It to the NET

Online lesson quiz at
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Web Code: afa-0901

65. The tangent of an angle is 7.5. What is the measure of the angle to the nearest tenth?

Mixed Review

Lesson 8-6

66. The area of a regular octagon is 100 cm^2 . Another regular octagon has sides that are three times as long. What is its area?

Lesson 7-2

The lengths of the sides of a triangle are given. Classify each triangle as *acute*, *right*, or *obtuse*.

67. 5, 8, 4

68. 15, 15, 20

69. 0.5, 1.2, 1.3

Lesson 6-7

70. For the kite pictured at the right, give the coordinates of the midpoints of its sides.

